CHEMICAL STERILIZATION

Terminal Learning Objective

1. Given a simulated CMS and the necessary supplies and equipment, sterilize medical equipment/supplies using an ethylene oxide sterilizer or other liquid sterilizing agents IAW cited references.

Enabling Learning Objectives

a. Given a list, select the properties, uses, advantages, and disadvantages of using ethylene oxide (ETO) as a sterilization agent .

b. Given a list, select the steps in sequence for preparing heat sensitive equipment/supplies for ETO sterilization.

Enabling Learning Objectives (cont..)

c. Given a list select the steps in the process for the sterilization of medical equipment and supplies in an ethylene oxide sterilizer (ETO).

d. Given a list, select the steps in the process for unloading and aerating ethylene oxide sterilized equipment and supplies.

Enabling Learning Objectives (cont..)

e. Given a list, select the features, advantages and disadvantages of hydrogen peroxide plasma sterilization.

f. Given a list, select the steps in sequence for preparing heat sensitive equipment/supplies for sterilization for a hydrogen peroxide plasma sterilizer.

Enabling Learning Objectives (cont.)

g. Given a list, identify the cleaning procedure for an ethylene oxide and /or hydrogen peroxide plasma sterilizer.

h. Given a list, select the types, uses, advantages, and disadvantages of using liquid sterilizing agents.

Enabling Learning Objectives (cont.)

i. Given a list, select the steps for disinfecting/sterilizing medical equipment and supplies using liquid sterilizing agents.

ETHYLENE OXIDE (ETO)

1. Properties
   a. In liquid state it is colorless and soluble in water.

   b. Odor similar to ether.

   c. Flammable in both liquid and gaseous state.

ETHYLENE OXIDE

2. Used on heat sensitive items unable to withstand temperatures of 250 degrees or higher.

   a. Endoscopes
   b. Plastic and rubber goods
   c. Delicate instruments.

ETHYLENE OXIDE

3. Advantages

a. Non-corrosive and non damaging to instruments or items being sterilized.

b. Effective against all types microorganisms to include spores.

c. Penetrates all porous materials and leaves no films

d. Automatic controls preclude human error by establishing proper levels of pressure, temperature, humidity and gas concentration.

ETHYLENE OXIDE

4. Disadvantages.

   a. Much time needed for aeration process.

   b. Highly toxic if inhaled. May be associated with:

      Spontaneous abortion, Genetic defects, Chromosomal damage, Neurological dysfunction.

ETHYLENE OXIDE

Disadvantages (cont..)

c. Long term exposure may cause cancer.

d. OSHA limits exposure of ETO. Personnel wear monitoring badges.

e. Highly explosive and flammable in both gaseous and liquid form.

ETHYLENE OXIDE

Disadvantages (cont..)

f. Expensive to operate.
   1. Vent gas to outside.
   2. Alarm systems installed.
   3. Automatic controls.

Ethylene Oxide

- Disadvantages Cont...
  - ETO does not penetrate glass
  - Hydrochlorofluorocarbon must be used in conjunction with ETO

ETO

- Functions:
  - Two Hazards
    - Opening the aerator door
    - Cleaning the interior of the chamber

ETO

- ETO:
  - Used to sterilize items that are heat or moisture sensitive.
  - Kills microorganisms and spores by interfering with the normal metabolism of protein and reproductive process, resulting in cell death. Must have direct contact with items.

ETO

- Sterilization with ETO is dependent on several factors and they are:
  - Concentration of gas: supplied in high pressure tanks. In the process air is taken from the chamber and ETO enters as gas under pressure. The operating pressure of the cycle influences the rate of gas diffusion through the package to be sterilized.

ETO

- Factor cont…
  - Temperature: This influences the destruction of microorganisms and effects the permeability of ETO through cell walls and material. As temperature is increased, exposure can be decreased. Temps range from 85 degrees F. to 145 Degrees F.

ETO

- Factors Cont..
  - Humidity: Moisture is essential in achieving sterility with ETO gas. Very dried bacterial spores can not be killed by ETO, so they must be hydrated.Items should be at least 50% humid but not less than 30%. A level between 30% and 80% is achieved through ETO sterilization. Excessive moisture will ruin load.

ETO

- Factors Cont...
  - Time: Using ETO is 1 ¾ hours to 12 hours depending on load. Follow your local SOP.

ETO

- Aeration:
  - All porous items must be aerated after processing to eliminate the toxic residues.
  - Mechanical aeration: 8 hours at 140 degrees F. or 12 hours at 122 degrees F.
  - Ambient Aeration: 7 days at room temperature 65-72 degrees F. depending on item.

Preparation of Heat Sensitive Equipment/Supplies for ETO Sterilization

1. Disassemble parts.

   a. Separate syringes.

   b. Remove impermeable parts.

Preparation of Heat Sensitive Equipment/Supplies for ETO Sterilization

2. Clean all parts.

   a. Cotton tipped applicators to clean delicate areas.

   b. Pipe cleaners to dry small diameter.

   c. Remove all lubricants.

Preparation of Heat Sensitive Equipment/Supplies for ETO Sterilization

3. Rinse and dry all items.

   a. Distilled or demineralized water to remove residues.

   b. Towel dry-no heat source.

   c. Air dry sensitive items.

   d. Blow dry hollow and metal or rubber items.

Preparation of Heat Sensitive Equipment/Supplies for ETO Sterilization

4. Packaging for ETO.

a. Characteristics/requirements.

(1) Non-Toxic.

(2) No holes.

(3) Permeable to ETO and aeration.

Preparation of Heat Sensitive Equipment/Supplies for ETO Sterilization

b. Material types.

(1) Nonwoven.

(2) Lint-free textiles.

(3) Moisture repellent.

(4) Heat-sealable pouches.

Sterilization Process for ETO

1. Loading procedures.

   a. Do not overload.

   b. Items may not touch chamber walls

   c. Leave space at top.

Sterilization Process for ETO

2. Sterility test controls.

   a. Biological Indicators.

   b. Chemical Indicators.

Biological Indicators

(1) Bacillus subtillis-highly resistant.
(2) Tests sterilizers effectiveness to destroy microorganism.
(3) Microorganism is in the indicator.
(4) Indicator is placed and run in sterilizer.
(5) Run in every load.

Chemical Indicators

(1) Chemical sensitive tape-outer package.Used as a external indicator that load has been penetrated by ETO.

(2) Chemical sensitive indicators-inside package.Used to indicate if ETO has penetrated material.

Factors Influencing Sterilization

a. Exposure time--3 to 7 hours.

b. Gas concentration.

c. Temperature--120 to 140 degrees F.

d. Humidity-- 40 to 80%

Sterilization Cycle

a. Phase 1-air evacuated.
b. Phase 2-steam or water vapor forced in.
c. Phase 3-sterilization begins.
d. Phase 4-pressure released from chamber.
e. Phase 5-air filtered into chamber.

ETO Unloading and Aeration Procedures

1. Unloading Procedures.

    a. Crack door 15 minutes.
    b. Minimize contact with items.
    c. Remove items wearing protective gear.
    d. Transport to aerator.

ETO Unloading and Aeration Procedures

2. Aeration.Crack door for 15 minutes to aerate before moving from sterilizer.

   a. Reasons for aeration.

      (1) Residual ETO causes burns.

      (2) Cannot use items until safely aerated.

ETO Unloading and Aeration Procedures

b. Time requirements.

(1) Mechanical Aeration

(a) Eight hours-140*

(b) Twelve hours-120*

ETO and Aeration Procedures

(2) Ambient aeration. (7 Days)

(a) Temperature-65-72* F.

(b) Items placed in well ventilated and clean room.

(c) Restrictive entry.

(d) No storage.

ETO and Aeration Procedures

3. Date items.

    a. Load control number.
    b. Expiration date.
    c. Keep a separate log book.

ETO

- Cleaning procedures:
  - Should be cleaned daily
  - Clean the chamber walls and floor with manufacturer recommended cleaning solution.
  - Clean the inner door and gasket. Remove foreign matter. Check wear and tear.

ETO

- Cleaning Procedure cont..
  - Flush pipes with warm water
  - Check the fittings and connections on the ETO tank regularly.

Hydrogen Peroxide Plasma Sterilization (Sterrad)

1. Features.

   a. Uses activated hydrogen peroxide.

   b. Low temp sterilization.

   c. Sterilizes metal, non-metal, and heat sensitive items.

Hydrogen Peroxide Plasma Sterilization

2. Advantages.

   a. Use items right after sterilization.
   b. No toxic byproducts.
   c. No need for aeration
   d. Printer records whole cycle.
   e. Sterilant provided in cassettes
   f. Provides non-toxic, dry, rapid, and low temperature sterilization.

Hydrogen Peroxide Plasma Sterilization

3. Disadvantages.

   a. Can not sterilize flexible scopes.

   b. Can not sterilize items that have long and narrow tubing or channels.

   c. Can not use in field.

   d. Can not sterilize large instruments.

Hydrogen Peroxide Plasma Sterilization

3. Disadvantages (cont.)

   d. All items must be dry.

   e. Loose arrangement of items.

   f. Items off walls of sterilizer.

   g. Concentrated peroxide is corrosive.

Preparation of Items for Sterilization in the Hydrogen Peroxide Sterilizer

1. Clean items thoroughly and wrap in polypropelene wrappers.
2. Place in designated pans.
3. Place BI test pack in chamber.
4. Sterilize per instructions.

Sterrad

- Cleaning procedures:
  - Outside surfaces with mild detergent
  - The chamber and door should be cleaned with mild detergent and soft cloth.
  - Never use harsh abrasives!!!!!

Liquid Sterilizing Agents

1. Types.

   a. Glutaraldehyde 2%-Cidex

   b. Peracetic Acid-(Sterris)

-peracetic acid, peroxide, and water.

Liquid Sterilizing Agents

2. Used for disinfections/sterilization.

   a. Immersible scopes.
   b. Instruments needed quick.
   c. Heat sensitive items.

Liquid Sterilizing Agents

3. Advantages.

    a. Effective against TB, spores, etc..
    b. No effect on glued parts.
    c. Less damaging.
    d. Less chance of human error.

Liquid Sterilizing Agents

3. Advantages (cont.)

   e. Peroxyacetic acid is non-toxic.
   f. Peroxyacetic acid is non-foaming, water soluble.
   g. Glutaraldehyde is not inactivated by blood.

Liquid Sterilizing Agents

4. Disadvantages.

   a. Items must be dry not to weaken solution.

   b. Glutaraldehyde has an odor- irritates eyes, throat and nose.

Liquid Sterilizing Agents

4. Disadvantages (cont.)

   c. Items must be rinsed.

   d. Items sterilized cannot be stored.

Liquid Sterilization Process

1. Disassemble equipment.

    a. Inspect for flaws.
    b. Clean items.
    c. Rigid scopes cleaned with soap
        and water.

Liquid Sterilization Process

2. Rinse under tap water and dry.
3. Processing with glutaraldehyde (Cidex)
    a. Sterile, deep pan.
    b. Activate solution.
    c. Large items on bottom.

Liquid Sterilization Process

3. Processing with Gluteraldehyde. (cont.)

d. Place lid on soak pan.
e. Record data on tape:

(1) Start time.
(2) Date.

Liquid Sterilization Process

e. Record data on lid. (cont.)

(3) Soak time.

(4) Date chemical will expire.

(5) Initials of technician.

Liquid Sterilization Process

f. Soak time.
    (1) 10 hours to sterilize.
    (2) Disinfections-10 to 20 minutes.
g. Obtain another sterile soak pan.
h. Don sterile gloves.
i. Immerse and rinse items thoroughly.
j. Place items on sterile field.

Liquid Sterilization Process

4. Process items for peroxyacetic acid.

    a. Special sterilization unit.
    b. Process per manufacturer.
    c. Trays included.
    d. Connect connectors.
    e. Insert container.

Liquid Sterilization Process

f. Close lid, press start.

g. Sterilization process.

    (1) Sterilization-12 minutes.

    (2) Temperature-122* to 131.9*F

h. Four rinses.

i. Sterile air injected.

j. Cycle ends.

QUESTIONS?